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Complete Specification entitled (54) BARGE CARRYING TRANSPORT VESSEL

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Related Art (56)

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60973/69		91.2
7116/66		91.2, 91.8

The following statement is a full description of this invention, including the best method of performing it known to us :

62694 /73

This invention relates to seagoing vessels, and in particular to seagoing vessels adapted to transport a plurality of barges. The design of the vessel, including the method of placing the barges thereon, is disclosed.

Various designs of carrier vessels which are partially submergible have evolved. These vessels partially submerge so that barges containing cargo can be floated onto the carrier vessel. However, none of these designs have been commercially successful, and the only current vessels embodying this approach have small barges raised by gantries and loaded aboard the carrier vessel. This approach requires large equipment to raise the barges, and is limited to relatively small barges.

All attempts to design a carrier vessel upon which barges could be loaded without lifting them out of the water have resulted in designs which, in one manner or another, were impractical. Many designs required the joining of independent parts to make up the total vessel, which is structurally impractical since the junctions cannot be made sufficiently strong to hold the vessel together in rough seas. Other designs, such as the patent to Wells, Patent No. 3,556,036, provided no continuous structural connection along the sides of the vessel, which results in a structurally impractical vessel design since fore and aft bending loads imposed on the vessel could not be conveniently counteracted. Further designs, such as the Patent to Wells et al., Patent No. 3,587,505, provided enclosed inner chambers which are filled with water when the vessel is being loaded. However, the maintenance of a large enclosed chamber filled with water results in the establishment of dynamic motion of the water contained therein independent of the ambient seas. This destablizes the vessel to the point that it cannot be controlled. Still further designs have required complex gating arrangements to prevent influx of the water to the load-carrying decks while the vessel is underway. These gates were large and cumbersome, and limited the size of the opening which could be used to admit the barges.

In one broad form the invention provides a vessel for transporting at least one or more cargo carrying barges comprising: a hull having a raised bow section for providing buoyant forward support to said vessel at all drafts thereof; a well deck mounted interiorly of said hull extending substantially horizontally parallel to the water lines of said hull, said well deck adapted to support on said hull said barges; at least one ballast volume defined within said hull for permitting said hull to float at a first shallow draft, when said ballast volume is empty, said ballast volume when empty being of sufficient displacement with respect to said hull to maintain said well deck above the water line of said vessel with said well deck fully loaded with cargo carrying barges, and at a second deeper draft when said ballast volume is full of ballast, said well deck submerged at said second draft to provide for floating of the barges thereover to place said barges thereon; means for flooding and emptying said ballast volume of ballast; a wing wall extending from the bow along each of the port and starboard sides of the vessel, said wing walls extending upwardly from said well deck to a preselected elevation above said well deck, and defining a continuously open unobstructed passage through the stern of said vessel for the entry and exit of cargo carrying barges extending substantially the width of said well deck; a portion of said preselected elevation of said wing walls deck selected to be below the water line of said vessel when said ballast volume is flooded to permit the entry and exit of water over said wing walls and above the water line of said vessel when said ballast volume is empty to retard entry and exit of water over said wing walls to said well deck; at least one tower on the port and starboard sides of

the vessel, said towers being spaced aft of the bow of said vessel, said towers having a water-tight elevation adapted to provide buoyant support to said vessel remote from said bow at all drafts of said vessel between said first shallow draft and said second deeper draft.

A still further object of the invention is to provide a carrier vessel having a well deck with slight positive camber. The need for excessive camber to provide high volume drainage is eliminated by the fact that the well deck is substantially filled with the barges to prevent a large accumulation of water.

An advantage of the slight camber is that the barge effectively bifurcates the well deck along the center line of the well deck overlying the keel and divides the water accumulated on the deck into sections on each side of the barge whereby formation of a large free surface of water is inhibited.

A further advantage of the cambered well deck is to provide drainage channels on each side of the well deck.

In another preferred form of the present invention there is provided a well deck which is tapered downward at the stern entrance to the well deck.

An advantage to tapering the well downward in the vicinity of the stern entrance opening is to allow for pitching of the barge as it is first being loaded and is not fully protected by the aft tower walls.

Another preferred embodiment of the invention provides a carrier vessel which has a relatively high beam to draft ratio, greater than 4.6/1, which is substantially higher than that found in normal cargo vessels.

An advantage to providing a high beam to draft ratio is to provide a wide cargo area which allows for the use of

relatively large barges. Since only one layer of barges is accommodated in the present invention, the width of the cargo area is far more critical than its height.

Another advantage of providing a high beam to draft ratio is that the carrying of a single layer of barges is economically feasible, and the use of only a single layer of barges results in a multitude of advantages as has been heretofore illustrated.

A further advantage of providing a high beam to draft ratio for the carrier vessel is the increase of stability gained both while the vessel is in the loading configuration and while the vessel is in the transporting configuration.

The invention will now be described by way of example only, with reference to the accompanying drawings, wherein:

Figure 1 is a perspective view of the vessel when empty.

Figure 2 illustrates the vessel in the loading configuration, with a barge in the process of being loaded.

Figure 3 illustrates the vessel in the fully loaded transporting configuration.

Figure 4 is an aft elevation view illustrating a loaded and secured barge on the vessel.

Figure 5 is a close-up perspective view of the forward portion of the forward barge mating with the conformed

forward section of the well deck and the wing wall.

Figure 6A, B and C present a series of top views illustrating the method of drawing the barges onto the vessel.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Figure 1, the vessel is illustrated in the configuration for transporting barges but with the barges removed. The vessel is composed basically of a hull 10 extending from the well deck 11 down to the keel (not visible). A wing wall 12 is located on the edge of the well deck 11 and fully encloses the well deck except at the stern of the vessel. Several tower walls are located on the wing wall 12. A forward tower wall 13 is located on the bow portion of the wing wall to provide a raised bow section. A pair of central tower walls 14 and 15 are located amidships, one central tower wall 14 on the port portion of the wing wall and one central tower wall 15 on the starboard portion of the wing wall. A pair of aft tower walls are located on the aft portion of the vessel, one aft tower wall 16 on the port portion of the wing wall and one aft tower wall 17 on the starboard portion of the wing wall. A series of ports 19 provide access from the well deck 11 to the surrounding sea for the discharge of water from the well deck.

The embodiment illustrated in Figure 1 is preferably adapted to transport barges carrying liquified natural gas, hence a vent stack 18 is provided at the stern of the vessel. The sole superstructure on the ship other than the bridge and living quarters 20 is located on the aft tower walls 16 and 17 and is used to support a control cab 21 suspended over the well deck 11. The superstructure is composed

of a catwalk 22 connected to the stacks 23 and 24 of the vessel. The use of stacks 23 and 24, which would be essential in any case, to support the control cab 21, plus the basic design of the ship results in an absolute minimum of superstructure. This lack of superstructure lowers the center of gravity of the vessel, and greatly simplifies the design of an efficient and stable hull configuration.

Since only a single load-carrying deck is used, the entire hull may be composed of ballast tanks. These ballast tanks are empty when the vessel is in the configuration illustrated in Figure 1, but can be filled with sea water to submerge the well deck 11 and place the vessel in the configuration for loading barges illustrated in Figure 2. The ballast tanks in the hull are substantially filled with sea water so that the well deck 11 and wing wall 12 are submerged, and only the forward tower wall 13, central tower walls 14 and 15, and aft tower walls 16 and 17 are above water. The combination of wing wall and tower walls provide a multi-level structure which is partially above water and partially submerged when the hull is in the loading configuration. The well deck is sufficiently submerged so as to allow slight clearance between the well deck and the bottom of the floating barge 30.

The barge is pulled into position by means of lines 31 and 32 attached to the bow of the barge 30 and connected to capstans 33 and 34 located forward of the intended secured position of the barge 30. The term capstans is used to define the drawing means, but is to be understood that alternative devices such as winches could be used as well. Line 35 is attached to the bow of the barge 30 on the starboard side

thereof, and is connected to a capstan 36 aft of the intended secured position of the bow of the barge so that lines 35 and 32 are crossed. Line 35 "wraps around" the bow of the barge, and together with line 31 and a corresponding pair of starboard lines provide control of the position and attitude of the barge 30 during the loading thereof. The pair of starboard lines consist of line 32 in combination with a hidden line attached to the bow of the barge on the starboard side thereof and connected to a hidden capstan on the aft starboard tower wall 17. To provide further control over the barge 30 as it passes through the aft entrance to the well deck 11, extendable rollers are provided on either side of the entrance. The port extendable roller 37 is illustrated in the extended position, with a similar starboard extendable roller hidden by the barge in the view shown. For added protection of the carrier vessel, rigid fenders 38 are provided which extend along the interior of each wing wall 12 to prevent contact of the barge with the wing wall.

As a second and third barge are loaded on the vessel, successively aft capstans are used to draw the forward lines. Capstans 33 and 34 cannot be used since the first barge 30 would be in the way. Loading of the aft barge 42 is illustrated by way of reference to Figures 6A, 6B and 6C. Lines 70 and 71 are attached to opposite sides of the bow of the barge 42, and run to capstans 72 and 73 on the starboard aft tower wall 17. As they are attached, as illustrated in Figure 6, the lines 70 and 71 are crossed. A corresponding pair of lines 74 and 75 are crossed and attached to capstans 76 and 77 on the port aft tower wall 16.

As the barge 42 is drawn toward the vessel, (Figure

6), the two pairs of crossed lines provide attitude control over the barge. When the barge reaches the stern entrance to the well deck 11, extendable rollers 37 are engaged (Figure 7). After the bow of the barge 42 passes the extendable rollers 37, the lines 71 and 75 attached to aft capstans 73 and 77 wrap around the bow of the barge as illustrated in Figure 8. In this position, the two sets of crossed lines provide fore and aft control of the barge as well as lateral and attitude control. The functions of the drawing lines and the control lines are reversed for unloading the barges. The loading operation can be supervised by personnel located in the suspended control cab 21, and the tower walls provide work platforms for the crew which can be used in the loading and securing of the barges.

Referring next to Figure 3, the vessel is illustrated fully loaded in the transporting configuration. The well deck is above water, and is substantially filled with barges 30, 41 and 42. Although the three-barge configuration illustrated is preferred, the invention is equally applicable to configurations with different numbers of barges. The wing wall 12 is also above water, and in combination with the tower walls provide additional freeboard for the vessel when it is underway. In the embodiment illustrated, the volume enclosed by the well deck 11 and wing wall 12 is at least 90 percent filled by the barges. At the stern of the vessel, the aft barge 42 substantially fills the entrance opening, occupying approximately 85 percent of the area thereof, which provided sufficient protection from following seas.

The barges illustrated are primarily adapted to

carry liquified natural gas, and a venting system must necessarily be supplied. The vessel illustrated has an integral venting system whereby the barges have vent pipes 43 attachable to corresponding pipes 44 on the port side of the carrier vessel. Pipes 44 are connected by internal pipes (not shown) to a vent stack 18 at the port side of the vessel. This system provides a unified means for venting excess natural gas vapor at the stern of the vessel (when permissible) in a manner calculated to minimize the dangers involved in transporting natural gas. Drain ports 19 also provide for drainage of liquified natural gas in case of accidental spills.

The means for accurately positioning and securing each barge in the transporting configuration is illustrated by way of reference to Figure 4. When the barge is still floating, as illustrated by dashed water line 51, and has been moved into the approximate transporting position, tandemly mounted push and pull rods 52 attached to an adjacent tower wall 53 are lowered to engage corresponding cruciform fittings 54 located on the barge. The push and pull rods are used to accurately position the barge 30 athwartships so that the center of gravity of the barge is aligned with that of the carrier vessel. After the barge has been positioned athwartships, tapered male pins 55, which are disposed in the well deck 11, are raised to partially engage corresponding tapered female apertures 56 on the underside of the barge 30. The female aperture 56 has successive tapers as illustrated so that when the tapered male pin 55 is extended, the barge 30 is approximately fixed to its transporting position. As the hull 10 of the carrier vessel is deballasted so as to raise

the well deck 11 above water to place the vessel in a transporting configuration as illustrated by water line 57, the barge 30 settles down onto the well deck 11 and the tapered male pin 55 is fully engaged with the corresponding female aperture 56 to exactly position and secure the barge in the transporting position as illustrated.

The conformation of the forward portion of the wing wall 12 and the forward portion of the well deck 11 to the bow of the forward barge 30 is illustrated by way of reference to Figure 5. The well deck 11 slopes upward as illustrated by inclined plane 61, and the wing wall 12 tapers inward as illustrated by the concave surface 62, to form a mutually tapered surface which conforms to the bow of the barge 30. This conformation streamlines the basic shape of the vessel, and minimizes the length of the vessel required to accommodate a given number of barges.

The claims defining the invention are as follows:

1. A vessel for transporting at least one or more cargo carrying barges comprising: a hull having a raised bow section for providing buoyant forward support to said vessel at all drafts thereof; a well deck mounted interiorly of said hull extending substantially horizontally parallel to the water lines of said hull, said well deck adapted to support on said hull said barges; at least one ballast volume defined within said hull for permitting said hull to float at a first shallow draft, when said ballast volume is empty, said ballast volume when empty being of sufficient displacement with respect to said hull to maintain said well deck above the water line of said vessel with said well deck fully loaded with cargo carrying barges, and at a second deeper draft when said ballast volume is full of ballast, said well deck submerged at said second draft to provide for floating of the barges thereover to place said barges thereon; means for flooding and emptying said ballast volume of ballast; a wing wall extending from the bow along each of the port and starboard sides of the vessel, said wing walls extending upwardly from said well deck to a preselected elevation above said well deck, and defining a continuously open unobstructed passage through the stern of said vessel for the entry and exit of cargo carrying barges extending substantially the width of said well deck; a portion of said preselected elevation of said wing walls deck selected to be below the water line of said vessel when said ballast volume is flooded to permit the entry and exit of water over said wing walls and above the water line of said vessel when said ballast volume is empty to retard entry and exit of water over said wing walls to said well deck; at least one tower on the port and starboard sides of the vessel, said

towers being spaced aft of the bow of said vessel, said towers having a water-tight elevation adapted to provide buoyant support to said vessel remote from said bow at all drafts of said vessel between said first shallow draft and said second deeper draft.

2. The invention of claim 1 wherein the beam to draft ratio of said hull is approximately 4.6/1.

3. A vessel for transporting at least one or more cargo carrying barges comprising: a hull having a raised bow section for providing buoyant forward support to said vessel at all drafts thereof; a well deck mounted interiorly of said hull extending substantially horizontally parallel to the water line of said hull, said well deck adapted to support on said hull said barges during the transporting thereof; at least one ballast volume defined within said hull for permitting said hull to float at a first shallow draft when said ballast volume is empty, said ballast volume when empty being of sufficient displacement with respect to said hull to maintain said well deck above the water line of said vessel with said well deck fully loaded with cargo carrying barges, and at a second deeper draft when said ballast volume is full of ballast, said well deck submerged at said second draft to provide for floating of one or more barges thereover for the placing of said barges thereon; means for flooding and emptying said ballast volume of ballast; a wing wall extending along each of the port and starboard sides of the vessel, said wing walls being located on the edge of the well deck and adapted to enclose the starboard and the port sides thereof, said wing walls adapted to be submerged when the hull is at the second deeper draft to provide communication of the sea thereover, and above water when the

hull is at the first shallow draft, said wing walls defining a continuously open

unobstructed passage through the stern of said vessel for the entry and exit of cargo carrying barges extending substantially the width of said well deck; a pair of aft tower walls in the aft portion of the vessel, one aft tower wall on the starboard portion of the wing wall and one aft tower on the port portion of the wing wall, said aft tower walls having water-tight elevations adapted to remain above water when the hull is at the second deeper draft to provide buoyant support at the aft portion of the vessel during the loading thereof.

4. A vessel as recited in claim 3 and additionally comprising a pair of central tower walls in the amidships portion of the vessel, one central tower wall on the starboard portion of the wing wall and one central tower wall on the port portion of the wing wall, said central tower walls having water-tight elevations adapted to remain above water when the hull is at the second deeper draft.

5. A vessel as recited in claim 3 wherein the well deck is tapered downward at the stern thereof.

6. A vessel as recited in claim 3 wherein the well deck has a slight positive camber.

7. A vessel as recited in claim 3 wherein the forward portion of the well deck and the forward portion of the wing wall are tapered to conform to the bow shape of the forward barge.

8. A vessel as recited in claim 3 wherein the well deck is substantially flat and adapted to carry substantially flat bottom barges.

9. A system for transporting cargo by sea comprising: a hull having a raised bow portion for providing buoyant forward support to said vessel at all drafts of said vessel; a well

deck mounted interiorly of said hull extending substantially horizontally parallel to the water lines of said hull; at least one ballast volume defined within said hull for permitting said hull to float at a first shallow draft when said ballast volume is empty, said ballast volume when empty being of sufficient displacement with respect to said hull to maintain said well deck above the water line of said vessel with said well deck fully loaded with cargo carrying barges, and at a second deeper draft when said ballast volume is full of ballast, said well deck submerged at said second deeper draft; means for flooding and emptying said ballast volume of ballast; a wing wall extending from the bow along the port and starboard sides of the vessel, said wing walls being located on the edge of the well deck and adapted to enclose the starboard and the port sides thereof, said wing wall defining a continuously open unobstructed passage through the stern of said vessel for the entry and exit of cargo carrying barges extending substantially the width of said well deck, said wing wall adapted to be submerged when the hull is at the second deeper draft to provide communication of the sea thereover and above water when the hull is at the first shallow draft to inhibit entrance of water from the sea onto the well deck; a plurality of barges adapted to float slightly above the well deck when the hull is at the second deeper draft whereby the barges may be floated over the stern of said well deck and secured over said well deck within the wing wall; at least one tower on the port and starboard sides of the vessel, said towers being spaced aft of the bow of said vessel, said towers having a water-tight elevation adapted to provide buoyant

support to said vessel remote from said bow at all drafts of said vessel between said first shallow drafts and said deeper draft.

10. A vessel for transporting one or more cargo-carrying barges, substantially as hereinbefore described with reference to the accompanying drawings.

DATED this FOURTEENTH day of JANUARY, 1977
TRIMARINER CORPORATION

Patent Attorneys for the Applicant
SPRUSON & FERGUSON

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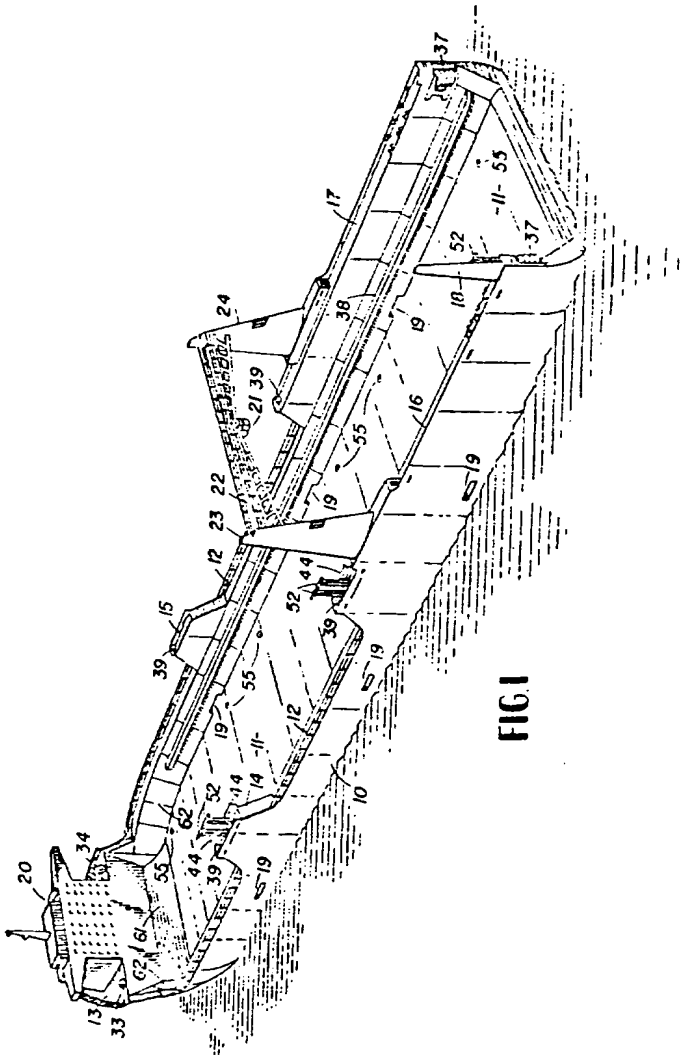

FIG 1

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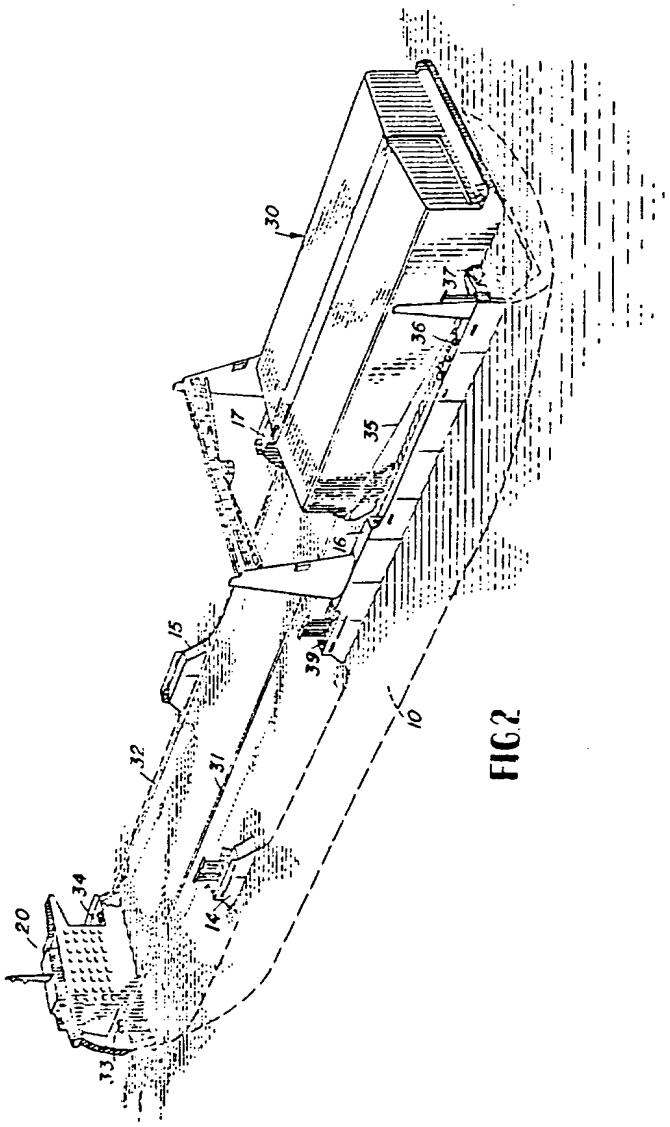

FIG.2

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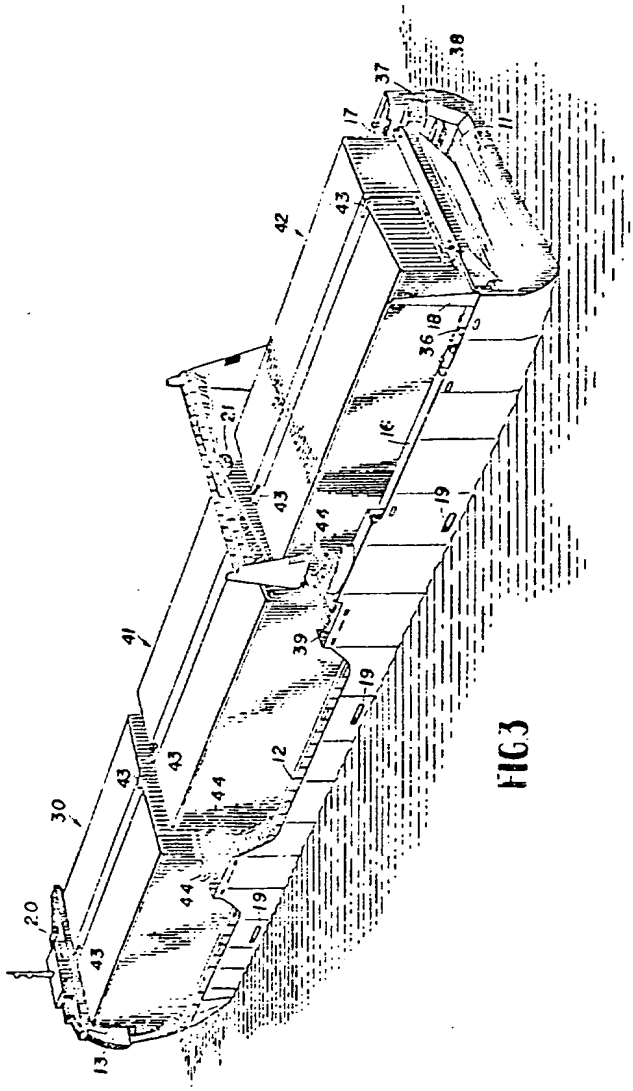

FIG3

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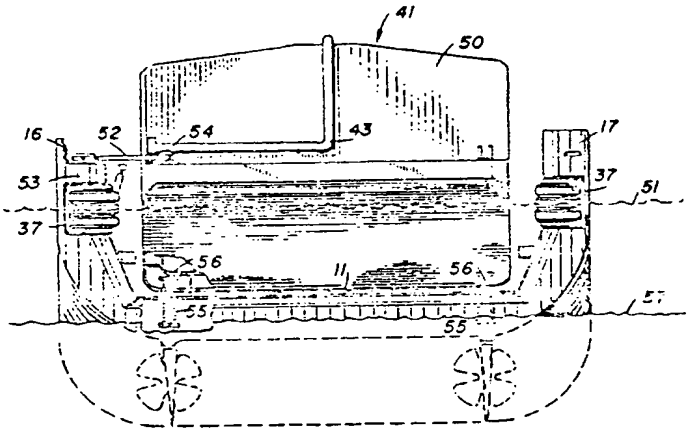

FIG 4

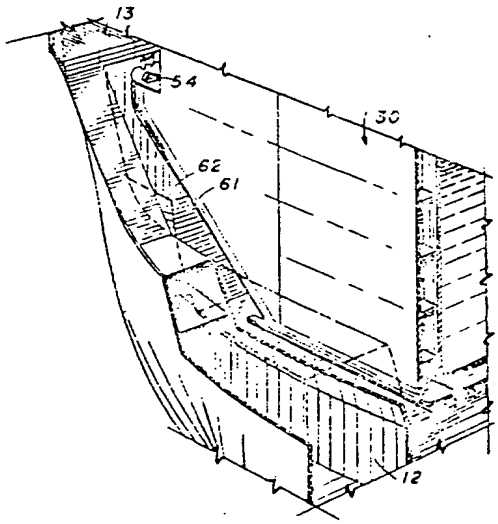

FIG 5

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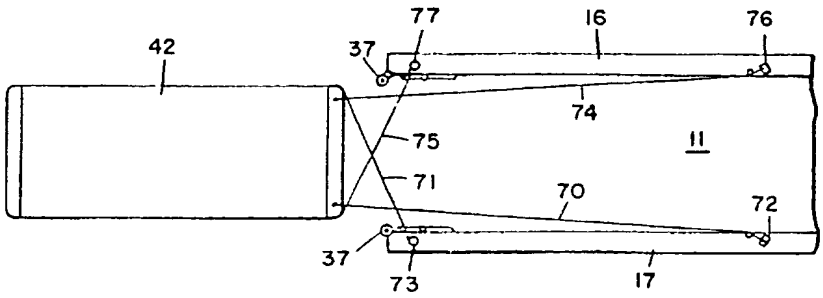

FIG.6A

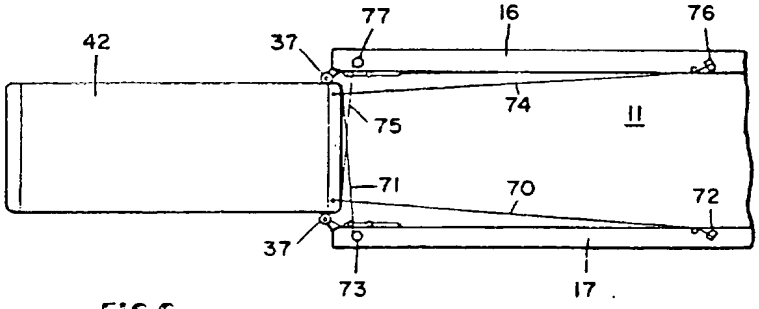

FIG.6B

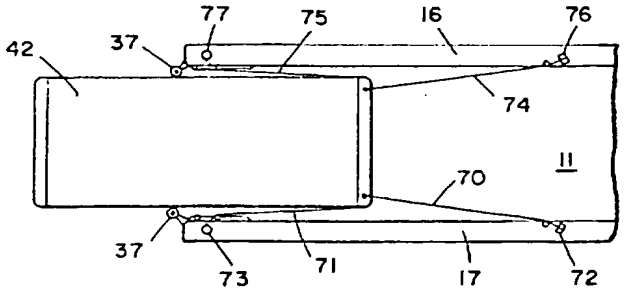

FIG.6C

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